~~Computer Systems~~

This invention relates to computer systems, and is concerned especially with computer systems of the kind that involve the interconnection or clustering of a multiplicity of processors.

~~Background of the Invention~~

It is known to form a computing system of the above-specified kind by interconnecting the processing units of a multiplicity of personal computers (PCs) and operating them in parallel with one another; such systems are sometimes referred to as 'Beowulf clusters'. The central processing units (CPUs) of PCs provide significant computing power at relatively-low cost, and advantage has been taken of this to form systems of the above-specified kind having very high computing power comparable with that of a specially-designed supercomputer, at a fraction of the supercomputer-cost. In such systems a multiplicity of PC-CPUs are interconnected and operated in parallel with one another as separate nodes of a local area network. These systems using clustered CPUs require the development of special software to enable parallel operation, and are generally slower than their supercomputer counterparts, but have significant advantage economically.

The CPUs of PCs are not designed to have the extended reliability to be expected of a supercomputer, so computing systems of the known form involving clustered CPUs are, in comparison, susceptible to faults. A fault occurring in an individual CPU will disrupt processing of the current application, and although the application can in general be re-started without replacement of the faulty unit, the disruption and loss of computing time involved is undesirable.

It is one of the objects of the present invention to provided a computer system of the said above-specified kind, which whilst having the potential for cost advantage of the known clustered PC-CPU systems, is less susceptible to fault disruption.

Summary of the Invention

According to one aspect of the present invention there is provided a computer system of the said above-specified kind wherein power supply to each processor is from a common power-supply means having fault-tolerating redundancy.

~~The computer system of the present invention may,~~ especially for cost-advantage, utilise processors that are a form such as used in the context of PC computers. However, in accordance with the present invention, rather than powering each processor from its own power-supply unit as in the case of the known form of computer system referred to above utilising PC-CPUs, they are powered from common power-supply means. The power-supply units of PC-CPUs especially, are not designed to have long fault-free operation so the likelihood of a fault arising in any of a multiplicity of clustered PC-CPUs, can be significantly high. The individual power-supply units might be replaced by units with a higher standard of reliability, but it is generally more economical to provide a common power-supply means and invest this with an even higher standard of reliability and, moreover, to ~~include fault-tolerating redundancy within it.~~

The processors of the computer system according to the invention may be carried by individual printed-circuit boards, for example PC motherboards, that are mounted together side-by-side within a rack-mounting. The rack-mounting may be contained within a cabinet together with the power-supply means.

The power-supply means may involve one or more power-supply units each of which comprises a plurality of power-supply modules which operate in parallel with one another in supplying power to the processors. The modules may each include diode or other circuitry that is responsive to the occurrence of a fault within the module (eg reduction in its voltage output in relation to that of the other module) to isolate that module effectively from the processors. Where more than one power-supply unit is involved, they may act in parallel with one another to power all the processors together.

Brief Description of the Drawings

A computer system in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a front elevation of the computer system according to the invention, with the front panel of the cabinet housing the system removed;

Figure 2 is a sectional plan of the computer system of Figure 1 showing only two of its five processing modules with one fully inserted and the other only partially inserted;

Figure 3 is a sectional side elevation of the computer system of Figure 1; and

Figure 4 is a schematic representation of the power distribution circuitry of the computer system of Figure 1.

Description of the Preferred Embodiments

Referring to Figures 1 to 3, the computer system of the invention is housed within a standard computer cabinet 1 which contains racking (not shown in detail) for

supporting five processor modules 2 side-by-side within the cabinet 1. Each processor module 2 includes an L-shape plate 3 (see Figure 3) by which it is supported in the cabinet 1, the plate 3 being held upright by engagement of its top and bottom edges 4 and 5 within grooved tracks 6 and 7, respectively, of the racking, so that the module 2 can be readily slid in and out of the cabinet 1 on the tracks 6 and 7. Handles 8 are provided at the front of each module 2 to assist with insertion and withdrawal, and power connection to the module 2 is established when the module 2 is fully inserted, via a two-part plug-and-socket connector 9 (shown as a single block) at the rear of the projecting base-part 10 of the L-shape plate 3.

Each plate 3 carries a PC-CPU motherboard 11 that is mounted in spaced face-to-face relationship with it immediately behind a front-panel 12 of the module 2. This enables data connections to be readily made with its processor 13 and a plug-in network card 14 (see Figure 3) and other circuitry (not shown) of the motherboard 11, via connectors 15 on the front-panel 12. The motherboard 11 is interconnected by wiring (not shown) for data interchange with a hard-disk unit 16 mounted on the projecting base-part 10 of the plate 3, and is powered along with the unit 16 by connections (not shown) from the connector 9.

Referring also now to Figure 4, power is supplied to all five processor modules 2 in parallel via a wiring loom 17 which interconnects their connectors 9 with two power-supply units 18. The units 18, which are mounted at the back of the cabinet 1 to lie above the base-parts 10 of the five plates 3, each comprise two, redundant power-supply modules 19. The two modules 19 supply power in parallel with one another, and each includes diode circuitry 20 (indicated in Figure 4 in the case of one

module 19 only). The circuitry 20 is operative to isolate the respective module 19 from its paired module 19 and the loom 17 generally, in the event that a fault occurs by which the voltage output of the module 19 falls so that current would otherwise flow to it rather than from it.

The two units 18 operate in parallel with one another in supplying power to the five processor modules 2, so that the operation in parallel of the four power-supply modules 19 is with a significant degree of redundancy for power-supply fault-survival.

The five processor modules 2 are interconnected via the connectors 15 and network cards 14 by data-cabling (not shown) to operate in parallel with one another as individual nodes of a local-area network and provide a high-powered computing capability. The PC motherboards 11 used, have a high degree of reliability, and that same degree of reliability is afforded to the computer system as a whole by the use of the highly-reliable form of powering adopted.

Although in the above example the modules 2 are operated in parallel, this need not be the case where, for example, a high processor density is required. A high processor density is required for example by internet service providers, when establishing a large number of web servers.